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ABSTRACT

This paper summarizes and discusses recent research in computer assisted instruction, specifically in the subject areas of reading comprehension and skills, composition, and organizational communication and information utilization. A "grounded theory" approach based on educational needs is proposed for future research. There are 26 references and an appendix listing over 140 commercially available online databases. (RAA)

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NEW TECHNOLOGY IN THE CLASSROOM:

COMPUTERS AND COMMUNICATION AND THE FUTURE

by

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NEW TECHNOLOGY IN THE CLASSROOM: COMPUTERS AND COMMUNICATION AND THE FUTURE

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(A paper prepared for the AERA Symposium: "Media Use and Learning: The Impact of New Communication Technologies on Children." Presented at the annual conference of the American Educational Research Association, Saturday, March 20, 1982, 12:25-1:55 p.m., Sheraton Centre Hotel Province Room, 3rd Floor.)

The 1980's are years of direct and radical changes in education. This has been particularly true with respect to recent developments within microprocessor-based instructional technology. The salient features of this change embody machines capable of the following functions: (1) computerized programming, (2) automated switching, and (3) electronic video display. (Towards More Effective Teaching and Learning, ICIS, 1981).

The rise of microprocessors, videodiscs, inexpensive home computers, videogames, and videotext data bases coupled with increased commercialization by entrepreneurs will "push" this educational technology into an increasingly cash-starved educational system looking for quick economic fixes. (TIME, "Portents of Future Learning," September 21, 1981, p. 65).

Building upon the premise that staff costs can be reduced through increased mechanization, more and more training and educational instructions will become semi-automated using a variety of programs on an even greater variety of machines with the capacity for switching and visual display. The first widespread adoption of computer assisted instruction is now occurring in business and industrial settings where computer courseware developers are in greater demand than classroom training instructors. (CDC, Consumers Digest, Sept/Oct, 1977)

The purpose of this paper is to review research in computer-assisted instruction, specifically in areas which deal with communication subject variables as measureable outcomes or effects. A model for future analysis is proposed.

Communication is a broad-spectrum discipline with skills in a wide variety of areas. Computer-assisted instruction already has been developed for communication areas, such as:

1. Reading comprehension
2. Literacy
3. Spelling
4. Vocabulary development
5. Discovery and utilization of bibliographic resources
6. Discovery of topics, invention of ideas
7. Writing (composing of sentences, developing paragraphs)
8. Interpersonal communication (networking, electronic information exchange, computer conferencing)

Generally, computer technology has been found comparable to conventional teaching methods in (1) cost, (2) retention of information, and (3) positive attitudes of learners. (Thomas, "The Effectiveness of Computer-Assisted Instruction in Secondary Schools, "AEDS Journal, 12, 3, Spring, 1979, pp. 103-116). Students using computers achieve mastery levels in considerably less time than students involved in non-computer-based programs of study. In 16 out of 17 studies, time of acquiring knowledge was significantly shorter. (Thomas, 1979).

Elisabeth R. Lyman (1977) reports thirty-five evaluative studies of the PLATO system in communication-related subject area categories. Botkin, Keen, McClellan, and Robinette (1981) report 23 current computer/communication projects with various stages of evaluational research reported for each.

For the purpose of this paper, the following communication subject-matter categories have been arbitrarily selected for discussion and summary of current research:

1. Reading comprehension and skills
2. Composition
3. Organizational communication and information utilization

Reading Comprehension and Skills. As early as 1974, Risken and others had developed reading materials for use on the PLATO system at the University of Illinois. Swinton, Amarel, and Morgan (1978), in a five year evaluation of the use of PLATO at the kindergarten and first grade levels, found no significant gains in achievement among pupils involved in the program. Moreover, the costs of developing the program were seen to be too high. Teacher needs for both feedback and control (communication variables) were also not met in the utilization of the computer in the teaching of reading.

Carver and Hoffman (1981) report significant gain in reading ability among students using a computer-based instructional system which provided for practice on repeated lessons. Thompson (1980) provides an exhaustive review of the applications and implications of computers in the teaching of reading and finds grounds for the utilization of computer-assisted instruction in the repetitive aspects of reading instruction, namely drill and practice.

Reporting upon an exhaustive evaluative study by the Educational Testing Service, Suppes (1980) concludes that there are small positive total effects of CAI in the language arts program which are measureable. With a new version, Reading for Comprehension, Suppes predicts significant improvements in reading over the traditional methods already observed at the college level (Suppes, et. al., 1977).

Although empirically-based research regarding the comparative effects of CAI over conventional approaches in the teaching of reading do not universally show improvements in learning, the preponderance of evidence supports marginal improvements in English skills, in general, and to a lesser degree in reading comprehension. (Alderman, 1978). Recent studies show substantial improvements in the teaching of literacy with the full utilization of computer-based instructional programs (Caldwell, 1980, Thompson, 1980)

Composition. Research at the Artificial Intelligence Laboratory at MIT supports the effectiveness of computer instructional programs to effectively teach six-year olds to construct and string sentences. (Robert Lawler, as cited in Towards More Effective Learning, 1981). Helen Schwartz (1980) utilized the computer to generate measures of readability upon segments of student writing thereby promoting improved composition styles and conciseness.

Burns and Culp (1980) report improvement by students in the areas of topical invention in English composition when using selected computer-assisted resources.

Nolan (1980) reports the effects of CAI programs in the improvement of spelling. Several doctoral dissertations on the teaching of writing are reported dealing with computer-assisted instructional techniques. (Teaching of Writing: Abstracts of Doctoral Dissertations, January-June 1980)

Vensel and Joiner (1981) describe a program in-progress in which the teaching of composition is being modified by the use of multiple word-processing typewriter-CRT units in a classroom. Either individual visual display units or a large-screen projection TV is being used for group writing and/or editing of an article or story. Utilizing this system the entire class is involved in the changing, deleting, or moving of various portions of the text. Thus, entire classes are jointly and discoursively involved in the editing process. Evaluational data on this type of composition program is currently being gathered in the Ortonville, Minnesota Public Schools.

Organizational Communication and Information Utilization. Research and evaluation of the role of the computer in organizational communication requires a departure from the conventional approach. When one considers the

computer as a sophisticated dispenser of educational materials, for example in the teaching of reading and writing, comparisons may more easily be made between a conventional teacher-led program and a computer-managed program. However, in the area of organizational communication and informational inquiry and utilization, the computer itself becomes a medium for both inquiry and exchange. In this case the intrinsic element of organizational communication, for example, is modified and adapted by the computer terminal itself.

A model developed to evaluate organizational communication under the NSF Electronic Information Exchange System proposed that the computer should be evaluated as a separate medium by which such variables as communication apprehension, credibility, and network cohesiveness could be achieved. (Schuelke, et. al., 1977) Crickman and Kochen (1978) report that verbatim comments support the conclusion that citizen participation in the development of science policy decisions was enhanced through computer conferencing techniques.

Research by Hiltz (1977) also presents a varied analysis of the effects of computer conferencing as a facilitator of organizational communication and a programmer for instructing participants within a communication network. Her findings indicate the need for careful adaptation of the computer in implementing selected organizational communication networks.

Reporting on the utility of a custom-designed information inquiry and exchange computer network for state legislatures, named LEGITECH, the Science and Technology Research Office of the Minnesota Legislature (1980) found the following disabilities of the system:

1. LEGITECH could not compete effectively with either the telephone or the research library as an information source.

2. LEGITECH suffered from a lack of quality and quantity of information.
3. The system was unreliable.
4. The system was too costly.

At the upcoming conference of the International Communication Association in Boston, several papers will report the effects of computer conferencing upon the organizational melieu (Heimstra, 1982 and Danowski, 1982). One may conclude that evaluation of the effectiveness of organizational communication via computer networks is not a problem of comparison as much as a problem of cost-effective application and evaluation. Just as the telephone has produced new forms and structures of communication, so too the computer may best be examined as a completely new medium of communication and learning without the parameters imposed by pre-existing methods and media.

In the area of information retrieval and utilization the establishment of databases, thesaruses, key-word indexing, and search protocols has virtually revolutionized the ways in which a person conducts bibliographic inquiry and also the way such activities should be presented. Although conventional card catalogs and reference resources may still be utilized, the commercially available online databases (see appendix) now frequently replace earlier, less exhaustive methods.

The technology of the computer has modified the nature and content of interpersonal communication required for satisfactory completion of the tasks involved. Comparisons between the old and the new methods are of some importance to the educator. Of greater importance is integration of the new technology into the teaching and learning of students.

A Needs Model for Computer/Communication/Education. Robert Cowen writing in Technology Review (May/June, 1981) explains that the future of education and of those of us involved in the teaching of various aspects of communication need to take the challenge of computers as communication tools seriously. Citing a recent position statement of the National Council of Teachers of Mathematics, Cowen calls for a new level of awareness and, perhaps, a whole new subject matter: computer literacy. The statement of the National Council of Teachers of Mathematics is as follows:

> ...computer literacy is an essential outcome of contemporary education. Each student should acquire an understanding of the versatility and limitations of the computer through firsthand experience in a variety of fields...

Cowen states that the largest area of involvement for computers will not be mathematics, but "information"--its generation, accessibility, dissemination, and use. (Cowen, 1981)

The question for future analysis regarding computers and communication is simply this: How can the utilization of the computer as a means of communication be most effective in the following teaching/learning areas?

1. Reading comprehension
2. Spelling
3. Vocabulary
4. Use of bibliographic resources
5. Writing
6. Interpersonal and organizational communication

In a summary study by the US Office of Technology Assessment (1981), the need for adaptation and implementation of computers into the teaching of communication (and information) is evident:

> Social scientists engaged in futures studies have suggested that the information revolution, spurred by both advances in computers and communication and by the changing role of information in U.S. society, will have profound long-term effects as dramatic as those caused by the invention of the printing press. Just as the printing press, by stimulating literacy and speeding the flow of ideas, supported the Renaissance and the transition from medieval society to the age of enlightment, so the new informational systems could profoundly transform the social and political environment of U.S. and world society.

The vitality of education, both teaching and research, depends upon the capacity of schools to meet the needs of human beings in society. The pervasiveness of computers into the communication and information behaviors of people require that a basic computer "literacy" becomes a part of our curriculum as communicators and educators.

Realizing that the conclusions of research studies cited earlier in this paper are not universally supportive of the utilization of computers in the teaching and learning of communication subjects, still it makes little sense to wait until the verdict is "in" on whether computers are (or will be) a part of our information and communication "futures." What the studies do tell us is simply that computers are so formidable a communication medium that they cannot be ignored.

The title of this paper mentions the future with respect to technology in the classroom. From a research viewpoint, future directions should be stimulating indeed. One of us (King, 1981), has suggested that the new technology will not only permit, but require, increased emphasis on individualized, competency based learning. If so, the classroom environment, as we know it today, will change greatly from a group-oriented to a more individually-oriented focus,

particularly with respect to basic skills. Certainly communication is among the most basic of these skills. Papert (1981), a disciple of Piaget, whose own research has led him into computers and learning theory, sees a very different world emerging:

> . . .we take for granted that there should be a gap between (the learning of) the spoken and written language. Children learn to speak as babies without formal instruction. But the written language comes later, if at all, and seems to require deliberate professional teaching. But why should this be so? Is writing really harder than speaking? I believe not and that the computer will close the gap.

Papert believes this will occur if the computer becomes an integral part of a child's early experiences, so that learning to communicate with or through machine becomes as enjoyable or necessary as communicating with people.

In summary, then we recommend the "grounded theory" approach to all such research: (1) decide what outcomes we are seeking regarding communication behaviors, (2) determine the most effective ways of applying the behaviors and the principles involved, and (3) evaluate the effectiveness of the methods and materials in terms of what is learned by students.

Regardless of the direction of these research activities, the computer will be a most dynamic and exciting tool for students to learn to use. It remains to be seen how effective future research shows these instructional technologies can become as more powerful, less expensive devices proliferate, quality courseware is developed and creative uses are devised.

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APPENDIX

Commercially Available Online Databases*

Social Sciences

AIM/ARM (vocational education)
Alcohol Use/Abuse
America: History and Life
Child Abuse and Neglect
ERIC (education)
Exceptional Child Education Resources
Historical Abstracts
Legal Resource Index
LISA (library science)
LLBA (Language and Language Behavior Abstracts)
NARIC (rehabilitation)
NCJRS (criminal justice)
NICEM (multimedia materials)
NIMH (mental health)
NIMIS (special education, media and materials for the handicapped)
PAIS (public affairs)
Population Bibliography
Psychological Abstracts
QUEBEC (current social science events from French-language newspapers)
Social Scisearch (Social Science Citation Index)
Sociological Abstracts
SPORT
U.S. Political Science Documents
U.S. Public School Directory

Multidisciplinary

American Statistics Index (ASI)
Biography Master Index
Booksinfo
CNI (Canadian Newspaper Index)
Comprehensive Dissertation Index
Conference Papers Index
Congressional Record
Encyclopedia of Associations
Federal Register
FEDEX (Federal Index)
Foundation Directory
Foundation Grants Index
Grants
LIBCON (Library of Congress)
Magazine Index (popular periodicals)
Monthly Catalog (U.S. documents)
National Foundations
National Newspaper Index
Newsearch

Humanities

Artbibliographies Modern
MLA Bibliography (language and literature)
philosophers Index
RILM Abstracts (music)

*Available through Lockheed Information Systems, Systems Development Corporation, or Bibliographic Retrieval Service as of October 1980.

Science and Technology

Aquaculture
Aqualine
Aquatic Sciences and Fisheries Abstracts
Agricola
APILIT, APIPAT (American Petroleum Institute)
APTIC (air pollution)
BHRA Fluid Engineering
BIOSIS
CAB Abstracts (agriculture)
Chemical Abstracts (includes Chemname, CA Patent, Concordance, CA Condensates, CA Search, Chemsis, Chemsearch, Chemdex, CAS 77, Chemcon)
CLAINS (patens; 8 parts)
COLD (Cold Regions Research and Engineering Lab.)
Compendex (engineering)
Computer and Control Abstracts
ELCOM (Electronics & Communications
Electrical and Electronic Abstracts
Energyline
Environline
Environmental Impact Statements
Environmental Periodicals Bibliography
Excerpta Medica
Food Science and Technology Abstracts
Foods Adlibra
FOREST
Geoarchive
Georef
INPADOC (patents
INSPEC (physics, meteorological and astrophysics, electrical engineering, computers)
International Pharmaceutical Abstracts
IRL Life Sciences
ISMEC (mechanical engineering)
Medlars (National Library of Medicine)
MEDOC (Eccles Health Sciences Library, University of Utah)
Metadex (metals and alloys)
NAL Serials (National Agriculture Library)
Non-Ferrous Materials
NTIS (National Technical Information Serv.)
Oceanic Abstracts
Paperchem
Pollution Abstracts
Physics Abstracts
PIE (Pacific Islands Research)
PNI (Pharmaceutical Newsletters)
RAPRA (rubber and plastics)

Science and Technology cont.

Ringdoc (pharmacy)
SAE (automotive engineering)
Safety Science Abstracts
Scisearch (Science Citation Index)
SPIN (physics)
SSIE (Smithsonian Science Information Exchange)
Surface Coatings Abstracts
TITUS (textiles)
TRIS (transportation)
TSCA (chemical substances)
TULSA (petroleum)
USDA/CRIS (agriculture)
U.S. Patents
Weldasearch
World Aluminum Abstracts
World Patents

Business

ABI/Inform
Accountants Index
Business
CBPI (Canadian Business Periodicals)
Chemical Industry Notes
Disclosure
EIS Industrial Plants
EIS Nonmanufacturing Establishments
Economics Abstracts International
Foreign Traders Index
Frost and Sullivan Defense Market Measure
Labordoc
Management Contents
P/E News (petroleum)
PIRA (paper industry)
Pharmaceutical News Index
Predicasts (includes Predicast:Prompt, PTS Federal Index, PTS F & S Indexes, PTS International Forecasts, PTS International Time Series, PTS Predalert, PTS U.S. Forecasts, PTS Time Series)
Standard and Poors Current News and S & P Cumulative News
Trade Opportunities and Trade Opportunities Weekly
U.S. Contract Awards
U.S. Exports
World Textiles